

AD-A139 779

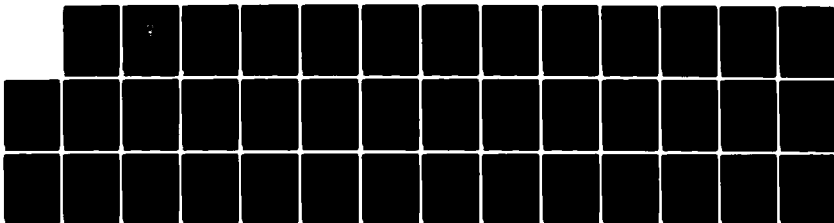
DATA COLLECTION FOR CAPITAL EXPENDITURE PROJECT
PROPOSALS: A CASE STUDY(U) NAVAL POSTGRADUATE SCHOOL
MONTEREY CA T R HARDING DEC 83

1/1

UNCLASSIFIED

F/G 5/1

NL



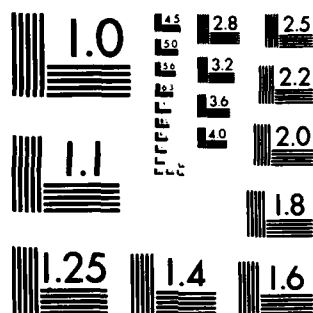
END

DATE

FILED

5 84

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD A139779

2

NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

DATA COLLECTION FOR CAPITAL EXPENDITURE PROJECT

PROPOSALS: A CASE STUDY

by

Terry R. Harding

December 1983

Thesis Advisor: Kenneth J. Euske

Approved for public release; distribution unlimited.

DTIC FILE COPY

DTIC
SELECTED
APR 05 1984
E

84 04 03 051

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A139 779	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) DATA COLLECTION FOR CAPITAL EXPENDITURE PROJECT PROPOSALS: A CASE STUDY		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis December 1983
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Terry R. Harding		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		12. REPORT DATE December 1983
		13. NUMBER OF PAGES 38
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report)
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Capital Budgeting Capital Expenditures Capital Expenditure Proposals		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Company investment procedures are frequently analyzed to ensure that there is no better way to meet established goals. (Dean, 1954; Wellington, 1983). These goals are usually to maximize the return on asset investment or achieve a desired growth rate in earnings per share. Much has been written about these processes, but the analysis usually begins at the point where all pertinent information regarding the proposal has been gathered. (Petty, 1925). This thesis investigates how this information is gathered. The research method was		

DD FORM 1473
1 JAN 73

EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

1

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

field research of three local organizations.

This thesis has four major conclusions. First, that vendor information is extensively used and in the case of the Corporate Farm, heavily relied on for cost data. Second, that historical information in the form of past contracts, sales receipts and rental agreements, are at a minimum used as a of reference for cost data estimation in all cases. Third, that the industry provides cost data either in the form of written cost estimating guides (in the case of construction) and by direct exchanges of information between organizations (in all other cases). Finally, that there is a high variance of procedures of data collection among the companies interviewed.

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	



Approved for public release; distribution unlimited.

Data Collection for Capital Expenditure Project Proposals:
A Case Study

by

Terry R. Harding
Captain, United States Marine Corps
B.S.M.E., University of Kansas, 1975
M.A., Central Michigan University, 1978

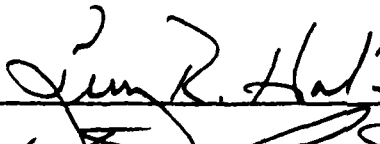
Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1983

Author:



Approved by:



Thesis Advisor



Second Reader



Chairman, Department of Administrative Sciences



Dean of Information and Policy Sciences

ABSTRACT

Company investment procedures are frequently analyzed to ensure that there is no better way to meet established goals (Dean, 1954; Wellington, 1963). These goals are usually to maximize the return on asset investment or achieve a desired growth rate in earnings per share. Much has been written about these processes, but the analysis usually begins at the point where all pertinent information regarding the proposal has been gathered (Petty, 1975). This thesis investigates how this information is gathered. The research method was field research of three local organizations.

This thesis has four major conclusions. First, that vendor information is extensively used and in the case of the Corporate Farm, heavily relied on for cost data. Second, that historical information in the form of past contracts, sales receipts and rental agreements, are at a minimum used as a point of reference for cost data estimation in all cases. Third, that the industry provides cost data either in the form of written cost estimating guides (in the case of construction) and by direct exchanges of information between organizations (in all other cases). Finally, that there is a high variance of procedures of data collection among the companies interviewed.

TABLE OF CONTENTS

I.	INTRODUCTION.....	8
II.	METHODOLOGY.....	11
III.	ORGANIZATION INTERVIEWS.....	14
	A. CORPORATE FARM.....	14
	B. MUNICIPAL TRANSIT AUTHORITY.....	19
	C. NAVAL FACILITY CONSTRUCTION.....	27
IV.	ANALYSIS.....	30
	A. SOURCES OF COST DATA.....	30
	1. Corporate Farm.....	30
	2. Municipal Transit Authority.....	30
	3. Naval Facility Construction.....	31
	B. DEPENDENCE ON VENDORS.....	31
	1. Corporate Farm.....	31
	2. Municipal Transit Authority.....	31
	3. Naval Facility Construction.....	31
	C. INITIATION OF PROJECTS.....	32
	1. Corporate Farm.....	32
	2. Municipal Transit Authority.....	32
	3. Naval Facility Construction.....	32
	D. FORMALITY OF THE CAPITAL EXPENDITURE PROPOSAL AND APPROVAL.....	32
	1. Corporate Farm.....	32
	2. Municipal Transit Authority.....	33

3. Naval Facility Construction.....	33
V. CONCLUSION.....	36
LIST OF REFERENCES.....	38
INITIAL DISTRIBUTION LIST.....	39

LIST OF FIGURES

I.	Purchase of a Tractor.....	17
II.	MTA Projected Annual Benefits of Computerized Information System.....	24
III.	Structure of Budget Process.....	35

I. INTRODUCTION

The financial health of an organization depends largely on sound decisions regarding capital expenditures. The decision to commit a sum of money to a specific business use presents both opportunities and constraints. Given that the capital available to an individual organization is finite, the decision to build a warehouse or buy a machine means that for a period of time those funds are denied to the any alternative uses. On the other hand, the act of investment opens up the possibility of a stream of financial benefits resulting from the use of the asset in the form of increased income or decreased cost.

In the financial management literature the procedures used by organizations to evaluate capital expenditure proposals are identified and discussed [Ref. 1]. The reasons for choosing a particular alternative vary. In personal interviews in eight medium and large firms conducted during 1969, Mao [Ref. 2] found that managers in general do not explicitly state that the objective of their firm is to maximize the market value of its common equity. This observation was substantiated by Petty, Scott, and Bird [Ref. 1] in a survey of Fortune "500" firms, which showed that managements consider several other goals to be more important than the maximization of common stock price. The respondents

in this 1975 study identified the following three goals as being most important to their firms:

1. To maximize the percent return on total asset investment.
2. To achieve a desired growth rate in earnings per share.
3. To maximize aggregate dollar earnings.

Although the goals differ somewhat there was general agreement on the basic factors that should be considered: market size, selling price, market growth rate, share of market, investment required, residual value of investment, opportunity cost, fixed cost, and useful life of the facility [Ref. 1]. The way the future return on the investment should be calculated -- if not agreed on -- is at least limited to a few methods, any of which can be consistently used in a given organization. Five techniques are widely used in industrial practice to estimate the attractiveness to the firm of a capital project [Ref. 1, 3]: net present value, internal rate of return, profitability index mode, average rate of return, and payback period methods. Three of these are considered "theoretically correct": net present value, internal rate of return, and profitability index models. Alternatively, the average rate of return and payback period methods are labeled "theoretically incorrect". There are variations on these methods, but these metrics are the ones

commonly adopted by firms that attempt to compute expected benefits from proposed capital expenditures.

If the input variables are well defined and the input data is valid and reliable, any of these methods could be used to rate investments and provide satisfactory (if not necessarily maximum) returns. All rating techniques depend on good data concerning project costs and returns. No ranking scheme is better than the data it is using. Therefore, an important question is what are the input variables. How is this information obtained? Is it standardized in all sectors? The purpose of this study is to investigate the "who" and "how" of data collection in the preanalysis phase of capital expenditure proposal development.

II. METHODOLOGY

This study was conducted in following manner. First, a literature search was conducted to determine the generally accepted methods of collecting data to analyse capital expenditures. Information was found on cost-benefit analysis decision making in capital expenditures and methodology of capitalization [Ref. 1-6]. But only in a few instances was there mention of the source of the initial figures. Assumptions about cost figures are used by the analyst or an average of differing opinions of costs with varying reliabilities and different ranges of probability may be used [Ref. 4].

It was then decided that interviews would be necessary to determine how capital expenditure data are collected. Organizations representing the private sector, federal government, and municipal government were selected to form a basis for comparison. Once the type of organization was determined, the actual organizations were selected based on convenience of the sample. Access to these organizations was solicited via letters followed by telephone calls. Fifteen solicitations were made resulting in a representative for each of the sectors desired.

An interview instrument was developed consisting of the following ten questions:

following ten questions:

(1) Would you take a recent example of a capital investment and trace it backwards from its approval?

The intent of this question was to cause the interviewer to relate a "story" that he knew and was comfortable with.

(2) What data/analysis is required in a proposal? This question was used to determine the structure of the data required by the company.

(3) What are the sources of data used in analysis? (external/internal, suppliers, estimates, etc...)

The answer to this question is the point of this study.

(4) If internally generated estimates are used, how are they prepared?

This question was necessary to get the source of data (the data behind the data).

(5) Are there any factors considered especially important or critical in the decision process? (market size, selling price, fixed cost, operating cost, life span)

This question was used to help determine the complexity of the company capital budgeting process.

Questions 6, 7, and 8 were all used to look at the differences between expenses and capital expenditures.

(6) How do you classify capital investment projects?

(7) Does classification influence needed data?

(8) How do you distinguish between expenses and capital expenditures?

(9) What elements of the proposal are presented to decision makers?

This question was used to help determine the complexity of the company's capital budgeting process.

(10) Who produces the proposal, is there a staff/corporation check on proposed analysis?

This question was used to determine who gathered, used and reviewed the data.

To help insure that accurate information was given, actual projects were used as the basis for discussion. This approach provided the author with reasonable confidence as to the reliability and validity of answers received. Questions 2-10 were designed to be used only as applicable to jog the interviewee's description of their project.

Analysis of the data collected was focused around the interview instrument in an effort to give the results comparability. The analysis identified by organization: (a) the source of the data and (b) who gathered the information. This was followed by a comparison of this information for the organizations interviewed.

III. ORGANIZATION INTERVIEWS

This chapter presents the results of the field interviews. The first organization is a corporate farm representing the private sector. The second is a public transit organization representing the municipal government. Finally, an example of building construction by the U. S. Navy represents the federal government.

It should be noted that in both the corporate farm and the Municipal Transit Authority the interviewees were pressed unsuccessfully for clarification on how some of the numbers that were presented were derived.

A. CORPORATE FARM

The interview was with a member of the board of trustees of a corporate farm. The farm consists of 6.5 square miles of crop producing land. The crops include tomatoes, beets and wheat. However, the largest percentage of production is tomatoes. Ninety percent of the farm's production is sold to one customer. The farm is sensitive to transportation costs because of the large volume of crops to be transported and the resultant fuel bills. This has resulted in recent land trading to gain a more advantageous geographic location. To improve the cash flow of the corporation during the off season, a game-bird shooting club is opened on the farm lands. Approximately 65,000 pheasants are

stocked each year at a cost of \$8.00 per bird. "Bird cards" are sold allowing the taking of 20-50 birds at \$16.00 per bird.

The proposal discussed was for the annual collective equipment buy. The farm is equipment intensive. The equipment are of three major categories: prime movers (e.g. trucks and tractors); pickers; and trailers. Annual capital expenditures for farm implements average \$200,000 per year. The method used for the analysis of the equipment buys is a short cut method for determining the economic value of simple capital investments. Calculations for a uniform annual cost are made. By definition, a uniform annual cost of a project is the pretax (annuity) value which must be received each year of the useful project life to recover all funds invested in the project and earn a specified after tax return on investment. This is represented mathematically as:

$$\begin{aligned} \text{Present Value} &= \text{Payment} (1 + \text{Hurdle Interest Rate}) \\ &\frac{[1 - (1 + \text{Hurdle Interest Rate}) - \# \text{ Years}] }{\text{Hurdle Interest Rate}} + \text{Balance} \\ &(1 + \text{Hurdle Interest Rate}) - \# \text{ Years} \end{aligned}$$

This cost is the annualized capital "cost of the project and represents the net benefits required. An adjustment is made for the investment tax credit when possible. This

method is used for all corporate investments that meet the following criteria:

- (1) Total investment occurs at project start.
- (2) Annual net benefits are constant throughout the project life (this criterion is at times violated).

Assume the company is considering the purchase of a \$50,000 tractor and that the specified internal rate of return is 15%. For the company to justify the purchase given the above assumptions and the parameters mentioned in the text, the investment (tractor) must return \$8,874.03 (see Figure 1) per year for nine and one-half years. If a 10% tax credit is considered, the required return drops to \$8,347.71. The decision to buy the tractor or find some other use for the \$50,000 investment will be predicated on two factors:

- (a) The projected revenue generated by the purchase of the tractor.
- (b) The after tax rate of return of the revenues generated by the purchase. The after tax rate of return is a "soft" number, largely dependent on the cost accounting system in effect.

The asset usually has a minimal salvage value at the end of the project life (this is nearly always the case for farm implements because tomatoes are corrosive). Depreciation is computed for the type or class of property and a tax rate of 50% is used. For buildings and other construction, straight line depreciation on asset life is used. New equipment will

FIGURE I.

PURCHASE OF A TRACTOR

Original Investment \$50,000 9.5 Year Life
Minimum Rate of Return 15% No Salvage Value

REQUIRED CASH IN 8874.03/YR = 84,303.29 PRE TAX ANNUITY LESS
10% INVESTMENT TAX CREDIT $\frac{5,000.00}{79,303.29} \times 9.5 = 8347.71/\text{YR}$

This is the absolute minimum cash in requirement to justify buying equipment, given the parameters and constant annual benefits throughout the project life. Because of the present value factor, this figure would be lower if constant flows were not assumed. Thus, this is the more conservative figure.

DEPRECIATION

Method - Double Declining Balance Through Year 5
Straightline Years 6 - 9.5

10,526	1st Year
9,288	2nd
8,050	3rd
6,811	4th
5,573	5th
2,167	6th
2,167	7th
2,167	8th
2,167	9th
1,084	.5
50,000	

Because of 50% tax rate, the federal government picks-up the tab for 50% of depreciation expense through lower taxes.

normally have a double declining balance on a nine and one-half year life with a switch to straight line after the fourth year. Life estimates are based on historical data. A zero salvage value is used for all tax depreciation calculations.

Projects, with rare exceptions, are initiated by the Vice-President for Operations. He gathers the cost data from vendors and puts together the proposals. The historical reliability of the vendor estimates is not verified. The vendors usually contact the company on a quarterly basis to keep current on farm operations. The Vice-President for Operations' office is located on the farm. Approval of projects is made by the board of trustees of which the Vice-President for Operations is not a member. All the members of the board of trustees have extensive knowledge of farm operations. Monthly updates on profit and loss, balance sheets and cash flows are presented to the board of trustees. This allows the board of trustees to be keenly aware of the internal economics of the company used in decision making. After a decision has been reached in the project evaluation that an asset should be acquired, the question becomes one of financing the asset. The farm will either buy or lease the equipment depending on which alternative has the higher net present value.

B. MUNICIPAL TRANSIT AUTHORITY

The interview was with the assistant general manager of a municipal transit authority (MTA). The MTA is a public organization which is subsidized for 2/3 costs with the remaining 1/3 coming from the ridership. The federal government subsidizes 80% of the 2/3 while the other 20% comes from the county. If the 1/3 non-subsidy is not raised then the federal subsidies are withdrawn. Excess funds must be returned to the federal government. Eighty percent of any salvage value collected upon disposal of equipment must be returned to the federal government. Approval for the expenditure of discretionary funds (proceeds from ridership) comes from the Committee for Decision Making. The general manager, assistant general manager, superintendant of operations, and the superintendant of transportation comprise a committee that makes decisions on capital investments referred to as the Committee for Decision Making.

If discretionary funds (proceeds from ridership) are used then a small amount of paperwork is required and approval for expenditure comes from the Committee for Decision Making. If municipal funds are used then a formal proposal letter is submitted to the county seat for expenditure approval. If federal funds are to be used then the highly structured federal funding process must be used with approval coming from the federal government. The

federal funding process for transit capital investments is on a five year cycle. This means that planning estimates are included in the funding proposal for five years hence.

The federal government specifies the requirements and specifications for buses. General Motors Corporation and Gruman Flex manufacture the only approved buses, so the choice is between the two. Bids from each company are solicited and the lowest one wins the contract award. The life of a bus is estimated at fifteen years. Replacement purchases of buses are driven by the life cycle. Decisions to add to the bus inventory result from the annual analysis of the routes. Bus routes are completely reevaluated annually. Partial route reevaluations are made as the need arises. Generally, route evaluations are based on ridership wants or needs and by City mandates or federal regulations as in the case of special routes for the handicapped.

When preparing a capital expenditure proposal the committee, as a matter of policy, contacts other transit organizations for cost estimates. These figures are then used in the budgeting process. The only exception in the last ten years was for the construction of a separate minor maintenance and operations facility. In this case a realtor and an architect were consulted for cost estimates. The architect prepared the plans for construction along with the cost estimates for that construction. The realtor provided the cost figures for the land required.

The project discussed with the MTA was for a computer system. The committee conducted a preliminary review of the MTA information system, the systems available from vendors, and the systems used by other transit companies, and concluded that a computer based system at MTA would be beneficial. This conclusion was based on the computer being able to increase:

- a. accuracy by capturing data only once and have the computer calculate and array data.
- b. timeliness by facilitating data entry and information retrieval (e.g., a more timely quarterly report).
- c. productivity by minimizing time spent on routine recordkeeping.

Given the decision to purchase a computer system a proposal was solicited. The conditions for the proposal include software applications for all financial and non-financial MTA information systems (e.g., maintenance scheduling, repair parts inventory, ridership and route data) and a hardware configuration of either one minicomputer with five terminals, a word processor, and printer, or a comparable configuration of microcomputers. These conditions were based on an analysis which considered information from other transit operators and various computer vendors, and focused on MTA's objective to increase productivity by minimizing operating costs and enhancing transit service. The benefit portion of the analysis was

based on forecast dollar savings and increased productivity to be achieved from a computer system. The cost portion of the analysis was based on the cost experience of other transit systems which bought computer systems which provide comparable benefits. The projected annual benefits were \$76,820. The benefits were derived from seven areas with more than one half the benefits from automating inventory management (\$29,639) and bus maintenance recordkeeping (\$18,425). The remaining benefits (\$28,756) were derived from automating timekeeping, personnel administration, and various files. The benefits were identified in two categories: 1) actual operating dollar savings of \$35,080 a year generated from inventory reduction and elimination of service bureau fees (with offsetting costs of \$6,780), and, 2) productivity improvements valued at \$41,740. Productivity improvements were based on interviews with persons responsible for each task, and took into account the current and projected degree of automation, and the experience of other transit properties having similar volumes of activity. The projected costs included an initial capital cost of \$165,000 and annual operating costs of \$10,272. These costs were based on a computer system currently used by other transit properties which generate benefits equivalent to the MTA. The finalization of these projections were based upon vendor responses to MTA's

requests for proposals. A comparison of projected costs and benefits indicated a pay back period of 2.5 years. The annual benefit over the first five years was \$33,548 which represents both real dollar savings and productivity improvements less cost. Annual operating expenditures were estimated to be reduced by \$28,300. A breakout of costs and benefits can be seen in Figure II.

The non-quantifiable benefits expected were:

- (a) Improved timeliness of information resulting from eliminating most of the time required for calculating and transcribing data.
- (b) Increased accuracy resulting from data being captured only once, calculations performed reliably, and reports printed from original data, not typed from a draft report.
- (c) Enhanced management, resulting from repetitive, routine transactions being automated, thereby freeing the staff to analyze information and make more informed decisions.

The board approved the project proposal, solicited vendor bids for a thirty day period, and then awarded a contract. The funding for this capital acquisition came from the state transit assistance funds. Further clarification of the data on which Figure II was based was refused by the interviewer.

FIGURE II.

MTA PROJECTED ANNUAL BENEFITS OF
COMPUTERIZED INFORMATION SYSTEM

A. INVENTORY SYSTEM

Reduce size of inventory	\$26,080	
Facilitate posting of receipts and issues	1,477	
Eliminate annual inventory calculations	1,491	
Generate purchase order	447	
Reduce inventory carrying costs	<u>144</u>	
TOTAL		\$29,639

B. VEHICAL MAINTENANCE SYSTEM

Minimize record keeping	\$10,208	
Increase productivity due to labor monitoring	5,478	
Enhance repair vs overhaul decision	<u>2,739</u>	
TOTAL		\$18,425

C. TRANSIT PLANNING SYSTEM

Reduce calculation time for UMTA trip sampling	\$ 6,372	
Reduce calculation time for monthly and quarterly reports	1,784	
Reduce bus/driver scheduling time	3,664	
Reduce preparation time for Short Range Transit Plan	1,593	
TOTAL		\$13,413

D. ACCOUNTING SYSTEM

Eliminate service bureau fees paid to B of A (less projected MTA operating supplies cost of \$480)	\$ 8,520	
Net labor cost of operating printer and computer inhouse	<u>200</u>	
TOTAL		\$ 8,320

E. DRIVER TIMEKEEPING SYSTEM

Decrease payroll data entry time	\$ 2,309	
Facilitate preparation of UMTA required Operators' Wage Schedule	<u>637</u>	
TOTAL		\$ 2,946

F. PERSONNEL ADMINISTRATION SYSTEM

Expedite retrieval and analysis of Accidents and Incidents file, and Driver Record File	\$ 972	
Reduce absenteeism due to closer monitoring	<u>1,053</u>	
TOTAL		\$ 2,025

G. FILES

Consolidation of bus stop information and easier access	\$ 1,485	
Computerization of six smaller files to facilitate sorting and retrieval of information	<u>567</u>	
TOTAL		\$ 2,052

Grand total annual benefits	\$76,820
Less annual operating costs	<u>-10,272</u>
Net annual benefits	\$66,548

MTA PROJECTED COSTS OF A COMPUTERIZED INFORMATION SYSTEM

INITIAL COST

Software, Hardware, Installation	\$160,000
Site preparation	3,000
Temporary labor to assist loading files	<u>2,000</u>
TOTAL INITIAL COST	\$165,000
Annualized for 5 years =	33,000

ANNUAL OPERATING COST

Hardware maintenance contract	\$ 6,000
Paper supplies (excludes financial supply costs which are deducted from benefits)	300
Computer manager for scheduling, control and maintenance	3,972
Computer terminal operating costs are deducted from benefits	<u> </u>
ANNUAL OPERATING COST	\$10,272

C. NAVAL FACILITY CONSTRUCTION

The interview was with the managing officer of a naval service facility and with the engineering technician/cost estimator of the host organization. The proposal that was discussed was for constructing a building. The estimated cost of the project was 2.5 million dollars. Projects with estimated costs up to \$5,000 are handled by the facilities department of the host organization. Projects with estimated costs over \$5,000 are submitted to a higher headquarters for tentative approval. The project submission and approval system initially encompasses three fiscal years. The system has two phases. In the budget phase, projects planned for the next three years are presented. While the emphasis is on the first year of the budget, major projects will be in budget as "out-year projections" for three years before they are actually "budgeted". The second phase involves transmittal of the individual projects for actual funding and takes place during the year the project was tentatively approved (budgeted). This results in the Navy obligating funds for actual expenditures and the assignment of a project reference number.

The public works department and facilities department are responsible for the preparation of the cost estimation forms required to be included in all submissions. These forms include:

- (a) Summary of facilities improvements, which has a description of work, justification of the work and cost of the project;
- (b) Preliminary project estimate for new construction, which includes building cost, support facility cost, design costs;
- (c) Navy project evaluation, which includes a summarization of the other forms.

All the cost estimates used in the preparation of these forms come from the cost estimating form which is prepared by an estimator who has been assigned to the particular project. The estimator is usually a civil service employee in the facilities department. The estimator may be a civil engineer, architect or journeyman of these disciplines. The official reference used for cost estimation is the Department of Defense Engineering Performance Standards (EPS). In their present version, the EPS are found in a collection of a dozen three-ring binders, each one-half to two inches thick. The estimator looks through these for the standards for each kind of job. Examples of these jobs are a standard cost for a two hundred-fifty car parking lot; twenty-five hundred feet of sidewalk; removal of trees; windows; storm drains; etc. The EPS is maintained by the Naval Facilities Engineering Command (NAVFACENGCOM) for the Department of Defense. They are subject to updating by NAVFACENGCOM. The update information is gathered by review and biannual industry survey and spontaneous field input. Each local facilities office has a cost estimate reference,

titled - Design Manual-10: Military Construction Cost Engineering Data (DM-10). This publication contains cost data that have been derived from historical cost figures of awarded contracts. However, the estimator interviewed maintains that the DM-10 does not keep pace with the industry and therefore is of little use. The estimator chooses to use the National Construction Estimator by Paul A. King. If an item is not in the EPS, DM-10, or the National Construction Estimator (which is rarely the case) or if there is doubt as to the currency of a cost figure, vendor catalogs or telephone contacts are used. The proposal estimates are submitted via NAVFACENGCOM for data approval and then to Commander, Naval Supply Systems Command for project review. This is true only for facility construction for use by this type of service organization. Other projects are reviewed and approved by other organizations. At project completion or beneficial occupancy, depreciation begins over a period of twenty years.

IV. ANALYSIS

The data analysis for each organization is structured around a series of questions. The questions are:

- A. What are the sources of cost data?
- B. How much dependence is placed on vendors?
- C. Who initiates the projects?
- D. How formal is the capital expenditure proposal and approval process?

These questions represent areas of potential interest that emerged during the interviews.

A. SOURCES OF COST DATA

1. Corporate Farm

Data collection by the Corporate Farm is primarily from vendors and secondarily from historical information on hand. Vendors are readily available with information on equipment prices, availability and new products. Historical information on equipment acquisitions in the form of past sales contracts, rental agreements and corporate knowledge of equipment is used as needed.

2. Municipal Transit Authority

Data collection by the Municipal Transit Authority is primarily from contact with other transit organizations and secondarily from vendors. MTA maintains an open exchange of information with other transit organizations across the nation. When a project is put together as much

information as is possible is taken from similar projects of other transit organizations. Vendor bids are usually used in the later stages of the project development.

3. Naval Facility Construction

Data collection in this organization is primarily from reference manuals, secondarily from vendors and historical information. Department of Defense and industry produce cost estimating guides which are used. In the event that these omit an item, vendors are contacted for that information. Data from past awarded contracts is sometimes considered for an initial rough estimation of costs.

B. DEPENDENCE OF VENDORS

1. Corporate Farm

Vendors are the primary source of information on costs for the Corporate Farm. An open dialogue is maintained with vendors with emphasis placed on service of existing equipment and prediction of needs of the farm.

2. Municipal Transit Authority

Bids for contracts are the primary reason for contact with vendors. The bids are solicited in the latter stages of the project development. Vendors are rarely contacted for the initial cost estimation.

3. Naval Facility Construction

Vendors are contacted by the Navy only when the needed item cost information is not in the reference manuals

used. This is not an uncommon situation but represents less than five percent of the volume of needed cost data.

C. INITIATION OF PROJECTS

1. Corporate Farm

Capital expenditure proposals are usually initiated by the Vice-President for Operations. He is the senior corporate employee who actually works daily at the farm. He is not, however, a member of the board of trustees.

2. Municipal Transit Authority

Capital expenditure proposals are initiated either by the committee for decision making or by individual members of the committee. The four members of the committee are: the general manager, the assistant general manager, the superintendent of operations and the superintendent of transportation.

3. Naval Facility Construction

Capital expenditure proposals are initiated by the managing officer of the facility to be constructed.

D. FORMALITY OF THE CAPITAL EXPENDITURE PROPOSAL AND APPROVAL

1. Corporate Farm

The Corporate Farm appears to be rather informal about its capital expenditure proposals. The Vice-President of Operations can say, "we need a new tractor and it will

cost about \$xxxx". He telephones a board member with the request and the board hands back the approval for a purchase. This is a somewhat simplified picture of the process but is basicly accurate.

2. Municipal Transit Authority

Capital expenditure proposals tend to be fairly formal. However, the degree of formality depends largely on the source of the funding. If discretionary funds (proceeds from ridership) are used then a small amount of paperwork is required and approval for expenditure comes from the Committee for Decision Making (i.e., the Committee proposes and then approves its own proposal). If municipal funds are used then a formal proposal letter is submitted to the county seat for expnditure approval. If federal funds are to be used then the highly structured federal funding process must be used with approval coming from the federal government.

3. Naval Facility Construction

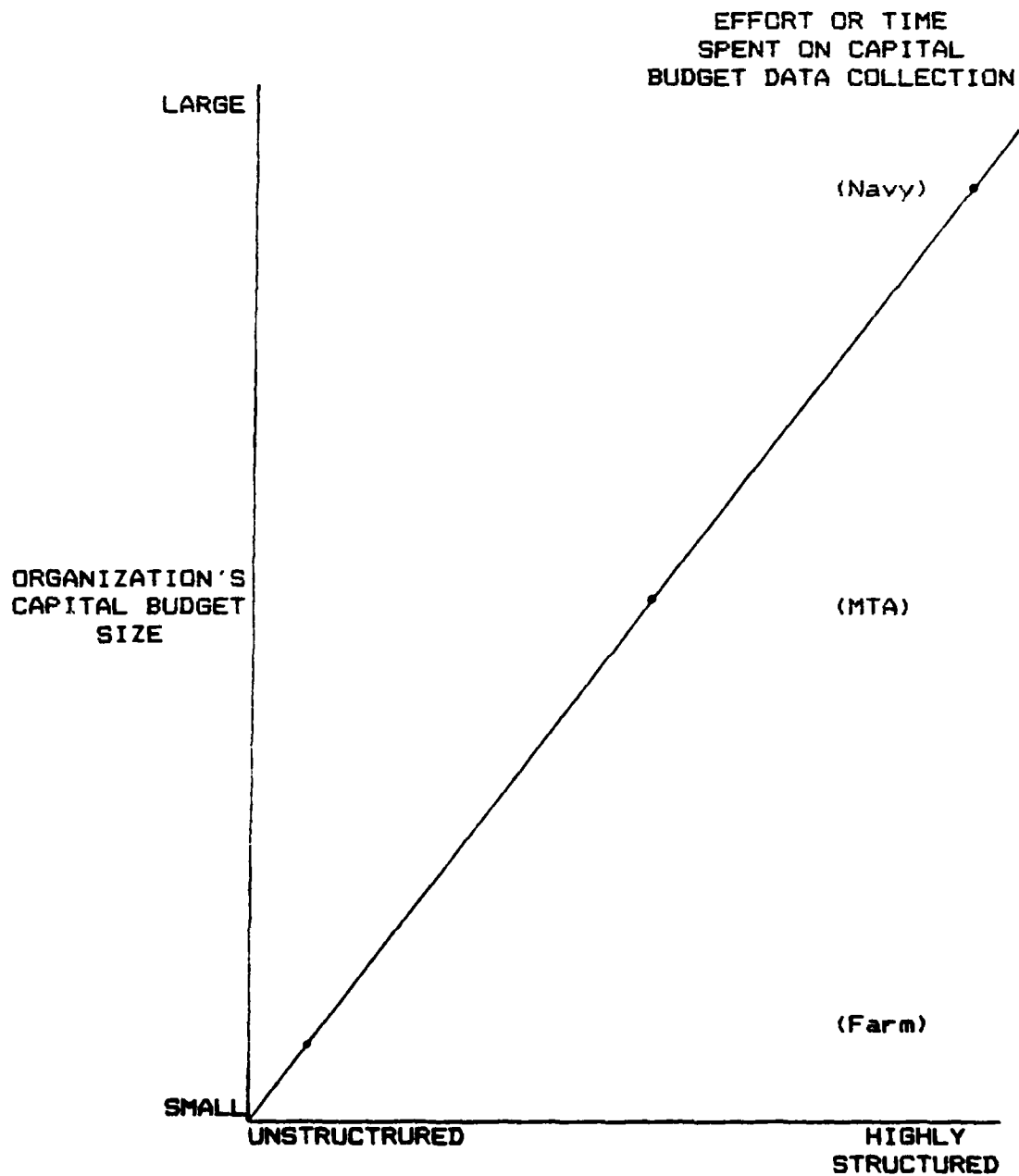
Capital expenditure proposals are submitted through the federal funding process for approval from a higher headuarters. This is a highly structured process.

Comparing the amounts spent on capital investments and complexity of the capital budgeting processes across the three organizations studied suggests an interesting relationship. It appears that the larger the capital

budget, the more formal and structured the budget process is. This can be seen graphically in Figure III. Both the MTA and the naval facility construction use variants of the federal funding process, but the details of their applications differ.

FIGURE III.

STRUCTURE OF BUDGET PROCESS



V. CONCLUSIONS

This study affords several conclusions. First, that vendor information is extensively used and in the case of the Corporate Farm, heavily relied on for cost data. Second, that historical information in the form of past contracts, sales receipts and rental agreements, are at a minimum used as a point of reference for cost data estimation in all cases. This is particularly true for budgeting where "ball-park" figures will suffice. Third, that the industry provides cost data either in the form of written cost estimating guides (in the case of construction) and by direct exchanges of information between organizations (in all other cases). Finally, that there is a high variance of procedures of data collection among the companies interviewed.

The objectives of the thesis were not fully achieved due to data problems. Problems were encountered in gaining access to organizations for interviews, and in interviewees refusing to respond fully to questions. Therefore, the conclusions presented can only be said to be tentative. Given the importance of capital investment decisions, further analysis of these issues with a larger sample would seem to be indicated. Such analysis should be directed in two different spheres. First, since this research

demonstrated differences among organizations in capital investment data collection, research should be directed toward both a description of and explanation for such differences. Second, research should be directed at developing perspective theories and their empirical support to guide firms in choosing methods of collecting data for capital investment analyses. Since capital investment analysis can be no better than the data on which they are based, further understanding of data collection is fundamental to better capital investment analysis.

LIST OF REFERENCES

1. Petty, J. W., Scott, J. R., and Bird, M. M., The Capital Expenditure Decision Making Process of Large Corporations, pp. 159-169, The Engineering Economist (Spring 1975).
2. Mao, J. C. T., Survey of Capital Budgeting Theory and Practice, pp. 353-356, Journal of Finance 25 (2), 1969.
3. Gitman, L. J., and Forrester, J. R., Jr., A Survey of Capital Budgeting Techniques Used by Major U. S. Firms, pp. 66-71, Financial Management 6 (3), 1976.
4. Fararr, D. E., The Investment Decision Under Uncertainty, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1962.
5. Bierman, H. and Smidt, S., The Capital Budgeting Decision, 3rd ed., pp. 26, 195, Macmillan, 1971.
6. Helfert, E. A., Techniques of Financial Analysis, 4th ed., pp. 117-157, Irwin, 1977.

INITIAL DISTRIBUTION LIST

	<u>No. Copies</u>
1. Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2. Library, Code 0142 Naval Postgraduate School Monterey, California 93943	2
3. Department Chairman, Code 54 Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943	1
4. Professor Philip Bromiley, Code 54Be Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943	1
5. Professor Kenneth J. Euske, Code 54Ee Department of Administrative Sciences Naval Postgraduate School Monterey, California 93943	1
6. Captain Terry R. Harding, USMC Code FDB Headquarters, Marine Corps Washington, D. C 20380	1